



Anatomical Variations of the Anterior communicating Artery among Sudanese populations –A Radiological Study

*Kamal Badawi¹, Aya Eltyb², Yasser Seddeg³

Department of Anatomy, The National Ribat University - Faculty of Medicine, Sudan¹

Department of Anatomy, The National Ribat University, Sudan²

Department of Anatomy, The National Ribat University - Faculty of Medicine, Sudan³.

Corresponding Author: *Kamal Badawi

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ABSTRACT:

Purpose: To determine the anatomical variations of the anterior communicating artery among Sudanese peoples.

Material and Methods: This is a cross-sectional study conducted in the Khartoum state at the Turkish diagnostic center. 40 subjects from different age groups were studied. MRA was used to study the anterior communicating artery variations.

Results: Regarding the morphological variation of ACoA, it was found to be normal about thirty-six cases (90%) of subjects, while it was absent in four cases (10%). The azygos artery had found just in five cases (12.5%) and the most of the individuals, thirty-five (87.5%) had normal A2-segment. No hypoplasia was seen. Types II and IV azygos was seen in one case for each (2.5%). Type V was seen in three cases (7.5%). No case was seen with azygos type III or type I.

Conclusion: Anterior brain circulation showed a lot of variations which should be kept in mind during diagnosis and surgical interventions. This results correlate with previous studies done worldwide.

Keywords: Anterior communicating artery, Hypoplasia, Azygos, Segment.

I. INTRODUCTION

The circle of Willis (circulus arteriosus cerebri) is an anastomotic system of arteries that sits at the base of the brain. The internal carotid artery (ICA) and the basilar artery form the circle of Willis. When the ICA enters the cranial cavity on each side through the carotid canal, then divides into the anterior cerebral artery (ACA) and middle cerebral artery (MCA). The anterior half of the circle of Willis formed by the two ACAs, connected to each other by the anterior communicating artery (ACoA), and is called (anterior circulation). While the posterior circulation is formed by the basilar artery (BA), which formed by the union the left and right vertebral arteries, then it gives off a left and right posterior cerebral arteries (PCA). The PCAs complete the circle of Willis by joining the internal carotid system anteriorly via the posterior communicating arteries (PCoA).⁽¹⁾

At the (4) mm stage of the embryo, the ICA develops from the dorsal aorta as a cranial extension. Later about (7-12) mm stage another longitudinal artery appears along the hind brain which coalesces to form the basilar artery. The caudal division of the primitive ICA anastomoses with ipsilateral artery and becomes the PCoA. The PCA on each side originates from the basilar as is the one of its terminal branches within the interpeduncular cistern, which completes the circle of Willis.^{(2),(3)}

II. MATERIALS AND METHODS

This is an observational descriptive cross-sectional study. The study was conducted at Turkish medical diagnostic center in Khartoum, Sudan. The study was held during the period between (September to December 2015). All individuals underwent MRA study in Khartoum state (Turkish medical diagnostic center) with normal ACA included. Those with history of ACA (occlusion or stenosis) were excluded. The sample group of this study was selected randomly among Sudanese individuals; they were 40 individuals, 16 females and 24 males.

III. STATISTICAL METHODS

The data were collected from the radiological images (MR angiography) by data collection sheet and analyzed using SPSS (Social Package for Statically Science), software version 20, as mentioned above and then were presented and described by using the tables and figures.

IV. STUDY SAMPLE CHARACTERISTICS

The sample group of this study was selected randomly among Sudanese population, who underwent the study of MRA during the period (September to December 2015) at the Turkish medical diagnostic center in Khartoum state, Sudan.

V. RESULTS

Regarding the morphological variation of ACoA, it was found to be normal in about thirty-six cases (90%) of subjects, while it was absent in four cases (10%), as it shown in table (1).

Table (1): Morphological variation of ACoA.

Variation	Frequency	Percent
Normal	36	90%
Absence	4	10%
Total	40	100%

As it was seen in table (2) and fig (1), the azygos artery had found just in five cases (12.5%) and the most of the individuals, thirty-five (87.5%) had normal A2-segment. No hypoplasia was seen.

Table (2): Morphological variation of A2-segment.

Variation	Frequency	Percent
Normal	35	87.5%
Hypoplasia	0	0%
Azygos	5	12.5%
Total	40	100%

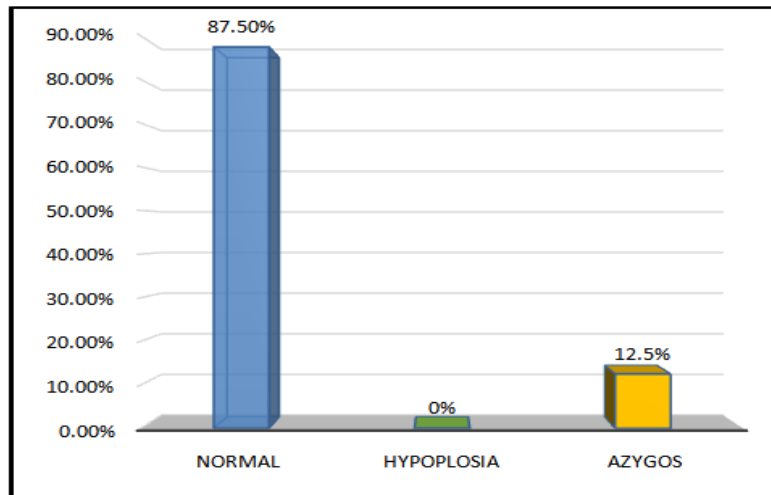


Fig (1): Morphologic variation of A2-segment.

Types II and IV azygos was seen one case for each one (2.5%). Type V in was seen in three cases (7.5%). No case was seen with azygos type III or type I as shown in table (3) and fig (2).

Table (3): Shows the types of azygos artery.

Azygos	Frequency	Percent
Type I	0	0%
Type II	1	2.5%
Type III	0	0%
Type IV	1	2.5%
Type V	3	7.5%
Total	5	12.5%

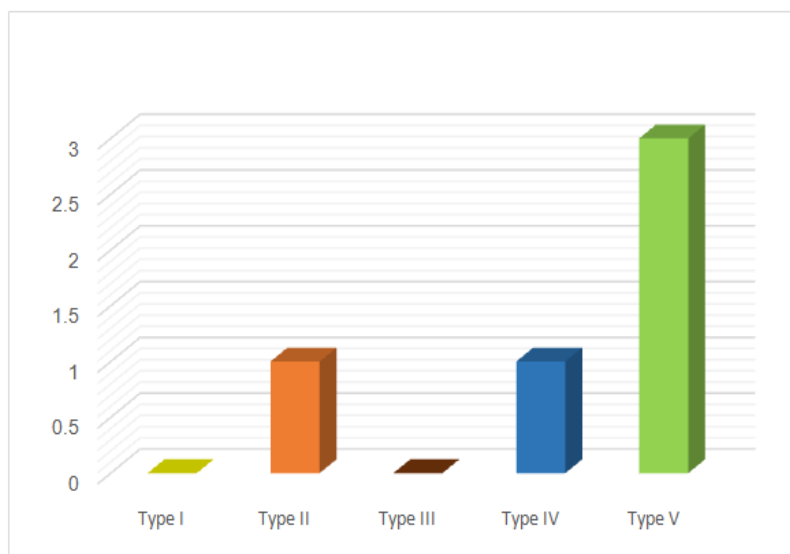


Fig (2): Shows the types of azygos artery.

In comparing the morphological variation between gender, the study revealed that the azygos found in four cases (10%) in males, while in females was seen in one case (2.5%). Also the hypoplasia found in two cases (5%) in males, but in females seen in one case (2.5%). The agenesis variation found equal in males and females which were seen in two cases (5%) for each.

VI. Discussion

The present study found that the ACoA was absent in four cases (10%) without fusion of ACA, which originated from other side, this observation was seen in three cases, one on the left ICA (2.5%), while two cases on the right ICA (5%), followed by agenesis in three cases and one hypoplastic case and also hypoplasia seen in the right side in three cases (7.5%), this finding is largely accords with the observations of study done by Sinha, et al, variation in the pattern of circle of Willis in human brain—a morphological study, at department of anatomy, Medical College, West Bengal, in India, studied out 80 specimens of human brains of both sexes, aged between 20-60 years. They found that the ACA, fused with the contribution, forming fused ACA in (5%) of cases. Fusion of the ACA may cause absence of ACoA or may it happens without fusion of ACA. Their observations largely corroborate with those of Windle (1888) and Alpers et al (1959) who recorded in(3%) and(2%) cases of absence of the ACoA, seen due to fusion of the two ACAs respectively. They declared that their observations fail to demonstrate the complete absence of ACoA without fusion of ACA and so unable to compare the finding with those of Fawcett et al (1905) who found complete absence of ACoA in (0.14%). Also they mentioned that the ACA artery may exist as a double variation. Another form of variation was found, that hypoplastic ACoA in (1.25%). No other form of abnormalities had been found in ACoA.⁽¹⁰⁾ The total variations found in the present study in ACoA was (6.25 %).

In study done by Sandhya A G, Rajendra N W, et al, department of anatomy, in India, they studied 112 brains. The morphologic variations which present, emphasized that the azygos ACA was found in 13 (11.6%). Five subtypes of the azygos ACA were found, as azygos type I in three cases (2.7%), type II in two cases (1.8%), type III in four cases (3.6%), type IV in three cases (2.7%) and type V in one case (0.9%). These observations corroborate with the present study that found azygos ACA in five cases (12.5%). Three subtypes of the azygos ACA were found, type II (2.5%), type IV (2.5%) and type V (7.5%). But azygos types I and III were not found in any case. In the same study the agenesis was observed unilaterally in A1 segment of ACA (1.8%). In one case it was seen on right side and on left side in the other. The duplication of A1 was seen in one case on right side (1.1%).⁽⁷⁾ Comparing with the present study the agenesis was seen in two cases on the right side (5%), and also two cases seen in the left side (5%) and no duplication was seen.

VII. CONCLUSION AND RECOMMENDATION

Anterior brain circulation showed a lot of variations which should be kept in mind during diagnosis and surgical interventions.

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